**Simple Experiments in Physics**

1. **String Wrap (forces, Energy, Torques,)**

In every western movie, the cowboy tethers his horse to the hitching rail outside the saloon, not by tying a knot, but simply by wrapping the reins a few times round the rail.

How does the friction of the wrap depend on the number of turns?

**2 Cantilever (SHM, Forces, F=kX, Energy,)**

A thin wooden beam, a metre ruler, with one end clamped to the tabletop, sags and wobbles. How does  
(a) the sag depend on the length of overhang,

(b) the period of oscillation depend on the mass loaded on the wobbly end,

(c) the period of oscillation depend on the length of overhang?

**3 (torques, SHM)**

**The Rocking Ruler**

The rule is placed on a cylinder of different radii.

The ruler is then made to rock.

Determine a relationship between the diameter (radius) and the period of the rocking ruler. I use old pieces of PVC piping that I have found on building sites from about 50mm to about 200mm in diameter.

**4 (Forces, torques, Projectile motion, PE KE Work)**

Take a pencil and put it on the edge of a table with part of the pencil overhanging the table. Get a small weight (20g or 50g) and drop it onto the end of the pencil. See what happens. A possible investigation could be to measure how high the weight was dropped and how far the pencil landed away from the table. Now change the height the weight is dropped. Is there any connection between the height it is dropped and how far the pencil lands from the table. What happens if you use different weights from the same height?

**5 (Electromagnetism and forces)**

Make an electromagnet by wrapping wire (wire with an insulating wire around it. There is lots of it inside old or broken inductors or transformers). You will also need a DC power supply that can deliver current of 1amp or more for best results. You will need about 1 to 1.5 m of wire per group

a How does the strength of the electromagnet depend upon the material it is wrapped around (try iron nails, copper nails, wood, plastic, zinc, carbon (from inside old batteries etc)? Measure the strength by how many metal papers clips the electromagnet will lift off the ground.

b Measure the strength and the current in the wire. (suggest they wrap their wire around the (soft) iron nails. They will need an ammeter to measure the current in the circuit. If you have not got an ammeter you could use a multimeter to measure the resistance of the wire coil and then the voltage supplied. Then use ohms law to calculate the current. This is not as good as an ammeter as the wire often heats up and so the resistance changes.

**6 The simple pendulum (SHM)**

This is a very good experiment after they have practiced a few and a good to do before their summative assessment as it has a lot of things they need to think about in it.

You will need about 1m of string, a clamp stand, a meter ruler and a stop watch and a mass of about 100 grams

Tie the sting to the stand so that the string can move backwards and forwards in an arc. The aim is to measure the period of the arc with the stop watch and see how it changes when the length of the string changes. The students will not get a straight line but could describe their graph with words like the “as the length increase the period still increases but the increase is not as fast as with smaller lengths or something like that. It needs good experiment techniques explained like repeated measurements at each length (repetition) and multiple measurements of the period (ie don’t just measure one period but measure say 5 periods (as some are very short) and then divide by 5 to get the period of one). These are good procedures to help reduce weaknesses like short period being difficult to measure. Also remember the length of the string is measured from the pivot point to the centre of mass of mass.

They could also investigate if the mass makes any difference to the period when it is swung (not in theory) or of the angle at which it is released makes any difference to the period or not (it does but the difference is sometimes very small to notice)

**7 Racquet Ball Conserves Energy!**

With a sharp knife or razor blade (caution!!!), slice a racquet ball into two halves. Trim each half so that it is slightly smaller than a hemisphere. Turn the he hemisphere inside-out and drop it, bulge-side-up, on a hard surface. The ball will snap and rebound to a height much greater than that from which it was dropped.

Work is required to turn the hemisphere inside-out and this work is stored as potential energy. As the dropped ball hits the hard surface, this potential energy is released and converted to kinetic energy, allowing the ball to rebound to a greater height.

Investigate how the rebounding of the inside out ball and the height it is dropped from.

**8 Moments (turning forces or moments)**

Im ruler, cork, nail, string, about 5 each of 20g and 50g 100g weights per ruler (group)

Put a small hole in the centre of a meter ruler (at the 50cm mark) Put a nail through this and then push this nail into a cork and then attach the cork to a clamp stand. The ruler should be balanced if the hole for the nail in the middle of the ruler. If it is not balanced then put some blue tack on the ruler close to the pivot point and place it so that the ruler balances.

Now tie some string to the weights and place one weight at any distance form the centreo fthe ruler. Now get another (different) weight and slide it along the ruler until it is balanced. Is there a connection between the where the weights are on each side and their distance form the centre. Try two weights and different distance on one side and one weight on the other side. Will this work? Is there still a connection between the weights and distances on each side of the centre of the ruler. Remember to measure all distances from the centre of the ruler

**Cupcake experiments (terminal velocity, mechanics),**

Stock Photo - chocolate cupcake. 
fotosearch - search 
stock photos, 
pictures, images, 
and photo clipart

Get a packet of these cupcake containers. Each group will need about 10 cup cake containers

If you drop these they quickly get up to terminal velocity and then travel at a constant velocity

One experiment is to prove that the cup cake containers do reach terminal velocity and let them design the experiment to prove this or not. You could also get them to do this:

Investigate the time taken for the cup cake container to drop and the number of cupcakes containers dropped

**9**

**Refraction experiment**

The main reason this makes the Snell’s Law experiment is easy is because you use a semi-circular glass block. The reason it makes the experiment simpler is because if a ray of light is shone towards the centre of the semi circular block it will come of the block along a radius and so it will not bend when it comes out

If you don’t have a semi circular glass block the you can still use a circular one but finding the centre is not so easy

Ray of light does not bend if it comes from the centre of the block. This makes it easier to measure the angle of refraction.

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**AC experiment**

If you have an oscilloscope and a multimeter this experiment shows that

Rms voltage=Peak voltage/√2

You will need a AC power supply that can supply voltages from about 2 to about 12 to 15 Volts, an oscilloscope, a multimeter a resistor (use a variable resistor if you wish and set it to about 10ohms), wires etc

Oscilloscope

Multimeter

Adjust the voltage so the peak voltage on the oscilloscope is 2V then read the multimeter. The multimeter reads the RMS value of the voltage (it will be about 1.4V). Record this result and then set the voltage so the peak voltage on the oscilloscope of 4 Volts (peak). Read the multimeter again etc. What is the relationship between the peak and RMS voltages. They have to find this out

**Some other simple experiments have already been handed out to schools as exemplars** like the “Crater” experiment and the “Stopping distance experiment”. Also there is a very good experiment given to some schools called “Water pressure and water flow”. This last one is not in the curriculum but is still a very good experiment as it is easy but has all points that are in the rubric. It would make a good practice experiment.

There are a lot of other experiments on the net and on some of the websites listed.on the sheet handed out called Physics Web Resources

I would suggest that you get at least 2 or 3 neodymium magnets. They are excellent for induction and electromagnetism. Go to Youtube and type in homopolar motor. Here is an example of using them to create the simplest electric motor I have ever seen

Below are a few more experiments you could consider

**Motion (distance velocity acceleration)**

Investigation of distance/ speed travelled by an object.

e.g. stopping distances of objects down a ramp, bicycles

Investigating the effects of friction between different surfaces

e.g. ‘margarine tub or coins or metal masses being propelled by elastic bands across surfaces

Practical investigation of air resistance forces on shapes, using a fan or when immersed in a

flowing liquid.

Investigating an object falling through a viscous medium like oil

Investigation of the effect on terminal velocity of the mass, volume and shape of an object (see the cupcakes experiment above)

Investigation of the factors affecting the design of a model parachute

e.g. What factors affect the rate of descent of a paper parachute.

Investigating the factors which affect the sag of a bridge

**Electricity**

Investigating the factors which affect the resistance of a wire

Investigation of current-voltage characteristics of different components (filament lamp)

Investigating the factors which affect the efficiency of electrical appliances

Investigations into the factors affecting the size and the direction of induced potential differences

Investigating the heating effect on water as a result of electrical heating

Investigating the factors that affect the strength of an electromagnet

**Waves and radiation**

Investigation into the effect of frequency on the waves peed of water waves and/or of waves travelling along springs or elastic strings

Investigation into the effect of water depth and/or the tension of a spring on wave speed and wavelength; the direction of travel of water waves when their speed changes

Investigating optical fibres/total internal reflection and/or measuring critical angles

Investigating the refraction of light through materials of different types and shape

Compare the transmission through glass of light and infrared radiation.

(Remember that you can use a cell phone camera to detect infrared radiation. Take a picture of a remote as you push the remote buttons and notice the bright spot. This is showing the infrared signal being sent))

Investigation of the materials that absorb, transmit or reflect infrared radiation